Monthly variation in observed activity of the Platypus *Ornithorhynchus anatinus*

Lyn Easton[1], Geoff Williams[2] and Melody Serena[2]

[1] 17 Northwood Drive, View Bank, Victoria 3084.
[2] Australian Platypus Conservancy, P.O. Box 22, Wiseleigh, Victoria 3885.

Abstract
Visual surveys for Platypus *Ornithorhynchus anatinus* were carried out in the Melbourne area along the Yarra River at View Bank (41 months) and at Toorourrong Reservoir near Whittlesea (8 months). The frequency of sightings peaked at both sites in winter, which is also the season when Platypus were most frequently captured in live-trapping surveys carried out in the Yarra catchment. The number of Platypus seen at Toorourrong Reservoir increased with cloud cover, though this relationship accounted for only 4% of the total daily variability in the frequency of sightings. (*The Victorian Naturalist* **125** (4), 2008, 104-109)

Introduction

The Platypus *Ornithorhynchus anatinus* is a relatively difficult species to survey and monitor: the animals spend much of their time either underwater or underground, and are active mainly at night (Serena 1994). They do not call, build conspicuous nests or burrows, or normally leave foot prints, diggings, food remains or scats as signs that they occupy an area. Platypus live-trapping surveys are logistically demanding, depend on the use of specialised equipment, and can be carried out legally only by gaining appropriate permits from relevant state authorities.

At the same time, the Platypus's aquatic habitat is spatially well-defined and often easily viewed from observation points on the adjoining bank, and the animals themselves are physically distinctive. Along with the fact that Platypus are regularly seen during daylight hours by a wide range of people in water bodies distributed across the animals' range, this suggests that visual surveys may potentially provide a valid technique for assessing and monitoring population levels.

This paper aims to assist the development of a reliable method for monitoring Platypus based on visual surveys, by addressing two questions:

1. Does the frequency of Platypus sightings vary between months in a given area?
2. How does the pattern of monthly variation in Platypus sightings compare with monthly variation in live-trapping results?

The effect of cloud cover on the frequency of Platypus sightings is also examined.

Methods

Visual surveys, Yarra River

Surveys were carried out along the Yarra River in the Melbourne suburb of View Bank from August 2003 to December 2006. Animals were observed from three sites along the walking track found on the river's north bank, located respectively just downstream of the mouth of the Plenty River and c. 170 m and 350 m downstream of the mouth. Each site afforded clear views of the river channel for a distance of at least 50 m upstream and 50 m downstream. At each site the observer stood quietly and scanned the river for 2-3 minutes, using 8 x 42 binoculars to confirm each animal's identity. Surveys were carried out mainly in the morning between 0800 and 0930 h (86%), with 2% of surveys occurring earlier in the day and 12% occurring later (7% from 0930-1100 h; 5% from 1700-1900 h). The Yarra at View Bank is typically 15-20 m wide and bordered on each bank by native riparian vegetation dominated by mature River Red Gums *Eucalyptus camaldulensis*. The number of Platypus inhabiting this segment of the river has not been documented through live-trapping surveys.

Visual surveys, Toorourrong Reservoir

Surveys were carried out at Toorourrong Reservoir from June 2000 to January 2001.

Animals were observed from approximately midway along the length of the dam wall, which provides an unimpeded view of most of the reservoir's c. 12 ha surface area. All surveys were undertaken on days of little or no wind when surface ripples created by platypus movements could be readily identified. The reservoir surface was scanned for c. 5 minutes, using 7 x 35 binoculars to confirm the identity of any Platypus seen in that time. In addition, the percentage of sky covered by cloud at the start of the observation period was recorded. Surveys were carried out mainly in the morning between 0800 and 0930 (85%), with 11% of surveys occurring earlier in the day and 4% occurring later (0930-1030h). Toorourrong Reservoir is located near Whittlesea township, about 5 kilometres south-west of the crest of the Great Dividing Range at the confluence of the Plenty River's east branch and Jacks Creek. It was built in 1885 and continues to be managed as part of the urban water supply system. Reservoir depth was fairly stable throughout the study, e.g. water depth recorded at a gauging rod located by the dam wall varied from 2.05-2.47 metres on days when visual surveys occurred, with 80% of readings ranging from 2.2-2.4 metres. Based on an intensive live-trapping study carried out from January to December 1995 (with nets set at monthly intervals until all captured animals were found to have been previously marked), the reservoir and its adjoining tributaries were estimated to support about 20-25 resident Platypus at the time that visual surveys were undertaken. Platypus habitat quality declines markedly a short distance downstream of the reservoir, with available live-trapping and sightings data indicating that the nearest breeding population occurs c. 20 kilometres downstream in the Plenty River Gorge (Serena and Williams, unpub. data).

Live-trapping surveys

Platypus live-trapping surveys were carried out at 217 sites in the Yarra River catchment (sampling 22 streams and the Yarra River at Warburton, Warrandyte and Heidelberg) from 1995 to 2007. The methods used to capture platypus have been described previously (Serena 1994). In brief, fyke (or eel) nets were set in pairs, with one net facing upstream and one facing downstream to intercept animals travelling in either direction. Platypus were directed into the main body of a net by extending netting "wings" across the width of the channel, and protected from drowning by securely staking the ends of nets out of the water. Nets were set in the afternoon and checked at regular intervals through the night, then removed from the water soon after dawn. The sex and age of captured animals were assigned based on the appearance of spurs located on the heels, enabling three male age classes (juvenile, $\leq$ 10 months; subadult, 11-23 months; adult, > 23 months) and two female age classes (juvenile, $\leq$ 10 months; adult or subadult, > 10 months) to be identified (Temple-Smith 1973).

Results

Visual surveys, Yarra River

Visual surveys were carried out along the Yarra River on 985 days in the study period. Considered on a monthly basis, the frequency of sightings peaked from June to August, when one or more animals were seen on 23-32% of survey sessions undertaken (mean or average number of Platypus seen per session = 0.31-0.37) (Table 1). Platypus were also seen relatively often in January (mean number seen per session = 0.20) and September (mean number seen per session = 0.17). The mean frequency of sightings in other months was 0.13 per session or less, with April providing the poor-

Table 1. Monthly variation in the number of Platypus seen in visual surveys along the Yarra River.

Month	N of days	N of animals Mean $\pm$ SD	% of days seen
January	85	0.20 $\pm$ 0.19	17.9
February	72	0.12 $\pm$ 0.10	12.2
March	78	0.05 $\pm$ 0.02	5.1
April	55	0.00 $\pm$ 0.00	0.0
May	84	0.11 $\pm$ 0.10	8.7
June	72	0.35 $\pm$ 0.15	31.0
July	81	0.37 $\pm$ 0.12	32.0
August	67	0.31 $\pm$ 0.04	23.4
September	107	0.17 $\pm$ 0.04	13.5
October	105	0.13 $\pm$ 0.09	11.8
November	89	0.09 $\pm$ 0.04	9.4
December	90	0.06 $\pm$ 0.03	6.2

est viewing opportunities (with no animals seen in April from 2004 to 2006). The variation in the number of animals seen among months is highly significant (one-way ANOVA, $F = 2.953$, $P = 0.01$).

Platypus were observed physically interacting with each other on two occasions. At 0930 h on 4 September 2004, two individuals (presumed to be males based on their relatively large body size and the large size of their bills relative to their heads) were seen to be grappling fiercely in the water, about 1 metre from the bank, generating a lot of noisy splashing. The animals' behaviour appeared to be the Platypus equivalent of two dogs fighting, as the animals reared partially out of the water, twisting their heads and bodies vigorously in an attempt to overpower and push each other down below the surface. This behaviour continued for at least five minutes, then abated (presumably as both animals tired), with the two eventually separating and swimming off in different directions.

On 7 August 2004, two animals (one very large and the other much smaller) were observed rolling over in tandem at the water's surface with their bodies pressed together and both animals facing the same direction. They made a slight splash as they disappeared underwater, and then both re-emerged separately at the surface. The larger animal then swam away downstream, while the smaller remained in the vicinity for a few minutes before also disappearing from view. Similar behaviour has previously been described in the context of a presumed Platypus mating observed at Lake Elizabeth in the Otway Ranges on 28 September 1998 (De-La-Warr and Serena 1999).

Visual surveys, Toorourrong Reservoir

The number of Platypus active on Toorourrong Reservoir was recorded on 118 mornings in the study period. Up to six animals were seen at a time, with no animals visible on only one occasion (93 minutes after dawn on 12 October 2000). The mean number of individuals observed per viewing session varied by month, from as few as 1.6 animals (in October) to as many as 3.7 animals (in August) (Table 2). The variation in the number of animals seen among months is highly significant (one-way ANOVA, $F = 6.801$, $P < 0.001$). The number of Platypus seen on a given occasion increased significantly with the amount of cloud cover (linear regression, $F = 4.161$, $P < 0.05$), though this relationship accounted for only 4% of the total daily variability in Platypus numbers.

Table 2. Variation in the number of Platypus seen in visual surveys at Toorourrong Reservoir by month and in relation to cloud cover.

Month	N of days	N of animals Mean ± SD (range)	% cloud cover Mean ± SD
June	12	3.4 ± 1.3 (2-6)	61 ± 44
July	14	3.1 ± 0.7 (2-4)	42 ± 42
August	18	3.7 ± 1.2 (1-6)	63 ± 46
September	13	3.6 ± 1.0 (2-5)	39 ± 49
October	17	1.6 ± 1.0 (0-3)	48 ± 46
November	16	2.9 ± 0.7 (1-4)	88 ± 16
December	15	2.8 ± 1.3 (1-5)	45 ± 48
January	13	2.6 ± 1.0 (1-4)	63 ± 41

While Platypus at Toorourrong spent most of their time feeding alone, one animal would occasionally swim directly towards another, generally starting from a distance of 30-100 metres. While the second animal sometimes responded by leaving the immediate area (with or without the second in pursuit), on other occasions the two would swim side by side for a short distance and/or feed near each other for several dives before gradually moving apart. One presumed sequence of courtship and mating was observed on 27 October 2000, when two animals began diving almost in synchrony after one approached the other in water approximately 1.5 m deep. The dives appeared to be typical of feeding sessions in terms of their duration and the distance travelled underwater. After each dive, one animal circled around and approached the other in a deliberate manner before both dived again, with the minimum distance between the two gradually diminishing over a nine minute period from 1.5 to 0.2 m. The presumed mating lasted about 30 seconds and resembled behaviour recorded in September 1921 by Burrell (1927) and in October 1943 by Fleay (1980), in that the two animals appeared to rotate around their longitudinal axis at the surface while facing in opposite directions, accompanied by periodic splash-

ing. After separating, one Platypus disappeared from view almost immediately, while the second disappeared three minutes later, after swimming towards the bank.

Live-trapping surveys

Fig. 1 summarises the results of 1085 net-nights of Platypus live-trapping survey effort (one net-night = one pair of fyke nets set at a given site overnight) undertaken in the Yarra River catchment along tributary streams or segments of the Yarra where at least one Platypus was captured over time. Capture rates for adult and subadult males remained reasonably uniform throughout the year, apart from a dramatic increase in capture rates from winter into early spring. There was about a four-fold difference in male capture rates when the least productive month (January) was compared with the most productive month (July).

In contrast to the results for males, capture rates for adult and subadult females showed two annual peaks, respectively occurring in summer (December-January) and winter (June-August). There was again a four-fold difference in female capture rates when the least productive month (April) was compared with the most productive month (January).

Discussion

Variation in monthly capture rates for adult and subadult Platypus is most readily explained by seasonal change in activity: the farther that animals travel, the more likely they are to encounter survey nets. In the case of males, capture rates peaked in winter and early spring when water temperatures are lowest, thereby requiring animals to expend more energy to stay warm. As well, the bottom-dwelling macro-invertebrates mainly eaten by Platypus (Faragher *et al.* 1979; Grant 1982) are likely to be both less abundant and less active in winter as compared to other seasons. Accordingly, it would not be surprising that Platypus have to move farther in a given night in winter to find enough to eat. As well, male mobility is expected to increase in winter and spring in response to the breeding season (with unhatched eggs and presumed matings recorded in the wild in Victoria from August to October (Griffiths 1978; De-La-Warr and Serena 1999; this paper). In practice, males may undertake periodic forays to relatively distant locations (presumably to investigate the availability of breeding females) and/or spend more time patrolling the boundaries of their home range (to reduce the risk of incursions by

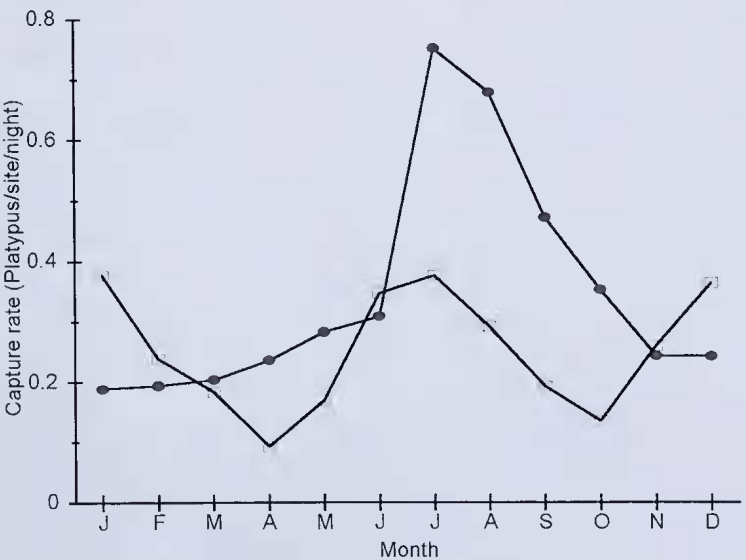

Fig. 1. Variation in capture rates of adult and subadult males (closed circles) and females (open squares) in the Yarra River catchment by month.

other adult males) (Gardner and Serena 1995).

Capture rates for adult and subadult females also increased in winter, though less dramatically than in the case of males. The difference presumably reflects the fact that both sexes must typically forage over larger areas to find enough food when water temperatures drop, but only males also travel to seek out or defend access to mates. A second peak in the rate of female captures occurred in December and January, which corresponds to the peak period for Platypus lactation (Grant 2004). Lactation is again predicted to cause females to forage more widely: in captivity, the amount of food consumed by a lactating mother of twins rose to c. 900 grams per day, as compared to c. 200-300 grams in the months before and after she was feeding her offspring (Holland and Jackson 2002).

The pattern of monthly variation in diurnal Platypus sightings along the Yarra River at View Bank is similar to the pattern of monthly variation in nocturnal live-trapping data for the Yarra catchment (Fig. 2), suggesting that both data sets are affected by the same underlying factor/s. Clearly, any increase in the distance that Platypus travel each day will contribute to the frequency of sightings by humans, given that more animals will on average swim past any point on the bank in a given 24 hour period. Heightened activity by Platypus to find food or mates may also result in animals being active for longer, causing more animals to be seen during the day. In theory, diurnality also might be fostered by greater competition for food, as animals seek to 'time-share' food resources. In addition, some Platypus might be expected to become less nocturnal during the breeding season to avoid hostile (or overly amorous) males (Gust and Handasyde 1995). However, any seasonal increase in diurnality that occurs at the expense of nocturnality should also tend to reduce Platypus live-trapping success (as survey nets are mainly open at night), which is not supported by the data presented here.

The average number of animals seen per survey session from June to January at Toorourrong (2.96) was about 14 times greater than the number seen per survey

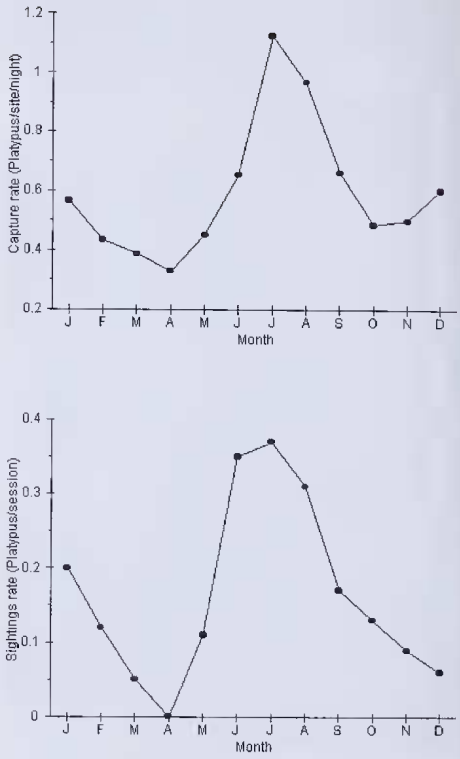

Fig. 2. Comparison of monthly Platypus capture rates in nocturnal live-trapping surveys (upper graph) with the frequency of diurnal Platypus sightings in the Yarra River (lower graph).

session over the same months in the Yarra River (0.21). This difference is roughly equivalent to the difference in the areas of aquatic habitat visible from the Toorourrong and Yarra viewing points, suggesting that Platypus population densities may be fairly similar in the two places. As in the case of the Yarra, Platypus sightings at Toorourrong Reservoir peaked in winter, extending into early spring. However, the frequency of sightings over the eight months when animals were observed at Toorourrong varied much less than in the case of the Yarra. This presumably reflects the fact that Toorourrong Reservoir and its incoming tributaries support an effectively closed population, with a large proportion of animals probably choosing to feed in the reservoir (as

opposed to its small associated streams) throughout the year.

In conclusion, visual surveys generate more limited data than do live-trapping surveys: reliable information about a population's sex ratio or age structure cannot be obtained using visual methods, and it is not possible to estimate population size accurately without marking and recapturing animals. However, the results presented here suggest that visual surveys may be usefully employed to monitor change in the relative number of Platypus occupying an area, as long as seasonal effects on the frequency of sightings are taken into account. The best months to conduct visual surveys (at least in the Melbourne area) generally appear to be June through September and January, particularly if Platypus population density (and hence the frequency of sightings) is likely to be low due to poor habitat quality or other factors. Finally, although cloud cover does increase the likelihood that animals are seen during the day, the relationship between the two factors is sufficiently weak that there would appear to be no need to take cloud cover into account when designing a visual survey program or interpreting its results.

Acknowledgements

Live-trapping surveys were authorised by Victorian Wildlife Research Permit RP-94-186 (and following) and Fisheries Permit FSP-CW-107 (and following). Funding to defray the cost of these surveys was provided by Melbourne Water, VicRoads, Shire of Nillumbik, Shire of Yarra Ranges, City of Manningham, City of Banyule, Golden Circle Corporation and National Geographic Society. We are also particularly grateful to the numerous volunteers who have helped set nets over the years, and the landholders who have allowed us (GW and MS) to gain access to streams through their properties.

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Received 6 December 2007; accepted 16 March 2008

One Hundred and One Years Ago

THE ANIMAL-LIFE OF THE SUNBURY DISTRICT SIXTY YEARS AGO.
BY ISAAC BATEY.

(*Read before the Field Naturalists' Club of Victoria, 8th July,* 1907, by A.G.Campbell.)

THE PLATYPUS, *Ornithorhynckus anatinus,* Shaw.—This singular mammal is still to be found on Jackson's Creek, principally on that part adjacent to Glencoe,Red Stone Hill, and the old Koorakoorakup station,portion of which is now occupied by the township of Sunbury. Though the Melbourne side has been settled for some seventy years, that section of the creek is not nearly so bare of these curious creatures as one would expect.In former times,though a Platypus saw you before taking his dive,if you waited quietly he would rise again not many feet from where the downward plunge was taken. Now they seem to have learned the habits of man, and once down they retire into their burrows. It seems to me this strategy accounts for their survival on Jackson's Creek, for had it not become alive to the sense of danger by this time it would have become extinct.

From *The Victorian Naturalist* **XXIV**, p. 70, August 8, 1907